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GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
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NISKAYUNA, NY 12309

EXAMINER	
PIGGUSH, AARON C	

ART UNIT	PAPER NUMBER
2838	

DATE MAILED: 06/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/604,800	SALASOO ET AL.	
	Examiner	Art Unit	
	Aaron Piggush	2838	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 August 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8,10-27,31 and 32* is/are rejected.

7)☒ Claim(s) *7, 9, 28-30, and 33-39* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 August 2003* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *18 August 2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: 410 in Fig. 4 and Fig. 5. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The abstract of the disclosure is objected to because of the following: It contains the title and legal phraseology, such as the term "said," both of which should be omitted. Correction is required. See MPEP § 608.01(b).

3. The disclosure is objected to because of the following informalities: The specification does not address number 410 in Fig. 4 and 5. Appropriate correction is required.

Claim Objections

4. Claims 1-4 are objected to because of the following informalities: The preamble of the independent claims, 1 and 3, recite "having one or more energy storage banks," however, the

claims describe comparing at least two different banks. Therefore, the preambles should be changed to recite, "having two or more energy storage banks." Claims 2 and 4 are objected to because of their dependency on objected claims 1 and 3. Appropriate correction is required.

5. Claim 17 is objected to because of the following informalities: Claim 17 depends on claim 17. To continue prosecution, it was assumed that claim 17 depends on claim 10. Appropriate correction is required.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1, 2, 5, 6, and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Ukita (US 5,905,360).

With respect to claim 1, Ukita discloses a method for equalizing a storage parameter for a vehicle energy storage system having one or more energy storage banks associated therewith, the method comprising:

identifying a quiescent period of operation for the vehicle (col 4 ln 2-8);

determining whether the value of a defined storage quantity for a first energy storage bank differs from the value of said defined storage quantity for a second energy storage bank by a threshold amount (col 9 ln 46-53); and

during said quiescent period of operation, discharging one of said first and second energy storage banks and charging the other of said first and second energy storage banks (col 4 ln 2-14 and Fig. 5 and 6);

wherein said one of said first and second energy storage banks corresponds to the bank having the value of said defined storage quantity exceeding the value of said defined storage quantity of said other of said first and second energy storage banks (col 9 ln 46-51 and Fig. 5 and 6).

With respect to claim 2, Ukita discloses the method of claim 1, wherein said defined storage quantity comprises at least one of: stored energy, relative stored energy, stored energy minus rating, stored charge, relative stored charge, and stored charge minus rating (col 9 ln 46-47).

With respect to claim 5, Ukita discloses a method for resetting a state of charge (SOC) calculation for a designated energy storage bank of an energy storage system of a vehicle, the method comprising:

during operation of the vehicle, completely discharging and completely charging the designated energy storage bank (col 2 ln 64-67);

maintaining the designated energy storage bank at a predetermined high terminal voltage for a specified period of time (col 2 ln 62-64); and

following said specified period of time, defining a calculated, reset SOC for the designated energy storage bank to be a known SOC capacity (col 2 ln 50-53 and col 5 ln 4-9).

With respect to claim 6, Ukita discloses the method of claim 5, wherein said completely discharging the designated energy storage bank further comprises discharging energy from the designated energy storage bank to at least one of: one or more available energy storage banks in the energy storage system, a vehicle motoring operation, and a resistive grid (col 2 ln 46-50 and col 3 ln 27-30).

With respect to claim 8, Ukita discloses the method of claim 5, wherein said completely charging the designated energy storage bank further comprises supplying charging energy to the designated energy storage bank from at least one of: one or more available energy storage banks in the energy storage system, a vehicle dynamic braking operation, and a combustion engine of the vehicle (col 9 ln 14-16 and col 3 ln 27-30).

8. Claims 3, 18, and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Hoffman, Jr. (US 5,869,950).

With respect to claim 3, Hoffman, Jr. discloses a method for equalizing a storage parameter for a vehicle energy storage system having one or more energy storage banks associated therewith, the method comprising (col 2 ln 5-8):

identifying an active period of operation for the vehicle (col 2 ln 9-10);

determining whether the value of a defined storage quantity for a first energy storage bank differs from the value of said defined storage quantity for a second energy storage bank by a threshold amount (col 2 ln 13-17 and 18-24, i.e. Hoffman, Jr. describes a module with a high voltage and one with a low voltage which therefore implies a threshold between the two);

during a motoring operation of the vehicle (col 2 ln 9-11), applying discharging energy from said one of said first and second energy storage banks to said motoring operation if the value of said defined storage quantity for said one of said first second energy storage banks differs from the value of said defined storage quantity for said other of said first and second energy storage banks by said threshold amount (col 2 ln 24-30 and col 6 ln 65-67 to col 7 ln 1-4).

With respect to claim 18, Hoffman, Jr. discloses a method for generating an energy storage control parameter for a vehicle energy storage system, the method comprising:

receiving energy storage electrical property information (col 16 ln 58-65); and

estimating, from said energy storage electrical property information, a storage bank temperature (col 16 ln 63).

With respect to claim 19, Hoffman, Jr. discloses the method of claim 18, wherein said energy storage electrical property information includes at least one of: internal resistance, change in internal resistance, equivalent series resistance, terminal voltage, and open circuit recovery time constant (col 16 ln 62-65).

9. Claims 10, 13, 14, 16, and 17 are rejected under 35 U.S.C. 102(e) as being anticipated by Ovshinsky (US 2003/0129459).

With respect to claim 10, Ovshinsky discloses a method for generating an energy storage control parameter for a vehicle energy storage system, the method comprising:

determining energy storage heat generation information (para 0178 ln 24-27);

determining energy storage coolant flow information (para 0155 ln 1-4);

and estimating, from said energy storage heat generation information and said energy storage coolant flow information, a storage bank temperature (para 0061 ln 15-17 and para 0133 ln 8-10 and para 0156 ln 8-10).

With respect to claim 13, Ovshinsky discloses the method of claim 10, wherein said determining energy storage coolant flow information further comprises receiving at least one of: a coolant flow measurement, a coolant fan speed, a coolant pump speed, a fan terminal power value, a fan terminal current value, a fan supply frequency, a fan voltage value, a pump terminal power value, a pump terminal current value, a pump supply frequency, and a pump voltage value (para 0165 ln 4-6).

With respect to claim 14, Ovshinsky discloses the method of claim 10, wherein said estimating a storage bank temperature further comprises receiving one or more actual temperature measurements within the vehicle energy storage system (para 0182 ln 5-6 and para 0183 ln 18-20 and para 0156 ln 2-7).

With respect to claim 16, Ovshinsky discloses the method of claim 10, wherein said storage bank temperature comprises a battery temperature (para 0165 ln 10-11 and para 016 ln 3-4 and 0061 ln 17).

With respect to claim 17, Ovshinsky discloses the method of claim 10, wherein said energy storage coolant flow information comprises airflow information (para 0165 ln 4-11 and para 0161 ln 9-13).

10. Claims 22, and 24-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Dunn (US 6,239,579).

With respect to claim 22, Dunn discloses a method for controlling a dynamic discharge rate for one or more energy storage banks in a vehicle energy storage system, the method comprising:

determining a charging/discharging rate of each energy storage bank within the energy storage system (col 2 ln 8-10); and

adjusting a calculated capacity value for each said energy storage bank, based upon said determined charging/discharging rate, so as to produce a modified capacity (col 4 ln 17-23);

wherein said modified capacity for each said energy storage bank is used in one or more energy storage system control algorithms (col 2 ln 23-24 and ln 10-13).

With respect to claim 24, Dunn discloses a method for controlling the operating range of one or more energy storage banks in a vehicle energy storage system, the method comprising:

determining a point at which the energy storage bank has reached a threshold value with respect to an end of life (EOL) condition (col 3 ln 15-16 and abstract ln 7-13); and

responsive to said threshold value, reducing at east one of an energy storage bank operating parameter and an energy storage bank operating range (col 5 ln 56-60 and col 3 ln 55-60).

With respect to claim 25, Dunn discloses the method of claim 24, wherein the energy storage bank further comprises a storage battery and said at least one energy storage bank operating parameter and said at least one energy storage bank operating range further comprises at least one of: a charging terminal voltage, a maximum state of charge (SOC), a maximum current flow, a maximum power flow, a maximum stored energy, an operating range between minimum and maximum SOC, an operating range between minimum and maximum stored

energy, an operating range between minimum and maximum stored charge, an operating range between minimum and maximum terminal voltage (col 5 ln 56-60 and col 6 ln 61-66).

With respect to claim 26, Dunn discloses the method of claim 25, wherein said threshold value with respect to an end of life (EOL) condition is based upon at lest one of: a total number of ampere-hours charged or discharged, a total number of kilowatt-hours charged or discharged, a total number of operating hours in charge or discharge mode, an elapsed time in operation, a number of vehicle missions completed, a total vehicle distance traveled, a vehicle total fuel consumed or energy supplied from an engine, an increase in calculated battery internal resistance or impedance, or reduction of charge or energy used to equalize a state of charge (SOC) calculation of said battery (col 4 ln 20-28).

11. Claims 27 and 31 are rejected under 35 U.S.C. 102(b) as being anticipated by Clegg (US 5,394,089).

With respect to claim 27, Clegg discloses a method for controlling one or more energy storage banks in a vehicle energy storage system, the method comprising:

determining a remaining life cycle for each of the energy storage banks (col 6 ln 13-17 and abstract ln 7-9); and

allocating a total amount of commanded charging and discharging power commanded among each of the energy storage banks in accordance with said determined remaining life cycle thereof (col 6 ln 30-33).

With respect to claim 31, Clegg discloses a method for characterizing and projecting remaining cycle life for vehicle storage battery, the method comprising:

performing a series of initial battery characterization tests (col 1 ln 20-26);

performing a series of periodic battery tests during the operating life of the vehicle storage battery (col 6 ln 10-12);

comparing the results of said periodic battery tests with said initial battery characterization tests (col 6 ln 9-15); and

projecting a remaining cycle life for the vehicle storage battery (col 6 ln 30-37 and abstract ln 7-9).

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hoffman, Jr. (US 5,869,950) in view of Kumar (US 6,615,118).

With respect to claim 4, Hoffman, Jr. discloses the method of claim 3 as noted above in the rejection under 35 U.S.C. 102(b), further comprising:

during a dynamic braking operation of the vehicle, applying charging energy generated by dynamic braking operation (col 3 ln 48-49). However, Hoffman does not expressly disclose applying the energy to said other of said first and second energy storage banks if the value of said defined storage quantity for said one of said first and second energy storage banks differs from the value of said defined storage quantity for said other of said first and second energy storage banks by said threshold amount.

Kumar discloses an energy capture and storage system (108 and 204 in Fig. 5) that selectively receives electrical power generated during dynamic braking and stores it (col 6 ln 5-7) and additionally states that excess power from one of the locomotives, which is working in a consist with another locomotive, can be transferred and stored in the other energy capture and storage system (col 6 ln 12-15), in order to prevent wasting the energy generated from dynamic breaking (col 3 ln 3-4) and therefore, the user can save on transportation costs.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method of storing dynamic breaking energy of Hoffman, Jr. to include the application of the energy to one of the storage banks which differs from the other storage bank by a threshold amount, so that the energy generated from dynamic breaking would not be wasted (col 3 ln 3-4) and therefore, the user can save on transportation costs.

It is understood that the other locomotive would contain its own energy capture and storage system, as to match the same description of the first locomotive, and furthermore, it is understood that because one energy storage system is at a full capacity and the other can still receive some of the energy from dynamic breaking, there is a difference or threshold between the voltage levels of the two storage systems.

14. Claims 11 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ovshinsky (US 2003/0129459) in view of Motsenbocker (US 2004/0090195).

With respect to claim 11, Ovshinsky discloses the method of claim 10 as noted above in the rejection under 35 U.S.C. 102(e), however, does not expressly disclose wherein said determining energy storage heat generation information further comprises calculating storage bank power dissipation information from at least one of: an energy storage power dissipation

measurement, an energy storage current measurement, an energy storage power command signal, and an energy storage current command signal.

Motsenbocker discloses monitoring the temperature and directing part of the charger current to a peltier device to pump heat out of the battery (para 0279 ln 9-12), which decreases the power delivered to the battery with increasing battery temperature (para 0280 ln 10-15 and pg 41 claim 24b ln 4-8), in order to attain the fastest possible charging by preventing the battery temperature from becoming too high where the battery can not be charged at the maximum charge current (para 0280 ln 1-4).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method for determining energy storage heat generation information of Ovshinsky to calculate storage bank power dissipation information from an energy storage current measurement or energy storage power command signal, as was the method of Motsenbocker, so that the fastest possible charging can be attained by preventing the battery temperature from becoming too high where the battery can not be charged at the maximum charge current.

With respect to claim 15, Ovshinsky discloses the method of claim 10 as noted above in the rejection under 35 U.S.C. 102(e), however, does not expressly disclose wherein said estimating a storage bank temperature further comprises utilizing at least one of: an energy storage cell thermal resistance value, an energy storage cell heat capacity value, an energy storage module thermal resistance value, an energy storage module heat capacity value, an energy storage assembly thermal resistance value, and an energy storage assembly heat capacity value.

Motsenbocker discloses the detection of excessive heat by one or more components of the power supply by using temperature sensors such as thermocouples (para 0116 ln 14-18), and he further discloses that relative temperature may be inferred from direct or indirect measurement of impedance because wire resistance changes with temperature (para 0115 ln 12-16), in order to warn against dangerous temperature levels and prevent degradation of the power supply (para 0110 ln 6-9), which is further elaborated upon by Ovshinsky who states that excessive heat can decrease performance and reduce cell life due to separator and seal degradation as well as accelerated degradation of the active materials (para 0151 ln 3-5).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method of estimating a storage bank temperature of Ovshinsky to utilize an energy storage module thermal resistance value, so that dangerous temperature levels can be avoided, and in turn, degradation of the power supply due to excessive heat can be prevented.

15. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ovshinsky (US 2003/0129459) in view of Kendall (US 5,619,417).

With respect to claim 12, Ovshinsky discloses the method of claim 10 as noted above in the rejection under 35 U.S.C. 102(e), however, does not expressly disclose wherein said determining energy storage heat generation information further comprises receiving at least one temperature measurement upstream from battery storage cells included within the energy storage system, and receiving at least on temperature measurement downstream from said battery storage cells.

Kendall discloses transmitting data, including temperature measurements, from a battery monitor upstream to the next battery monitor downstream and ultimately back to a central

computer (14, 16, and 18 in Fig. 1 and abstract ln 9-12 and col 1 ln 6-8), in order to decrease risk of electrical shorts that result from a high degree of wiring complexity and to decrease weight and volume because a smaller battery system prevents tight packaging constraints (col 1 ln 25-27 and ln 31-34).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method of determining energy heat generation information of Ovshinsky to receive a temperature measurement upstream and downstream from the battery storage cells, as was the method of Kendall, so that there is a reduction in risk of electrical shorts that result from a high degree of wiring complexity and a reduction in weight and volume because a smaller battery system prevents tight packaging constraints.

16. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hoffman, Jr. (US 5,869,950) in view of King (US 5,659,240).

With respect to claim 20, Hoffman, Jr. discloses the method of claim 18 as noted above in the rejection under 35 U.S.C. 102(b), however, does not expressly disclose wherein said estimating a storage bank temperature further comprises receiving one or more actual temperature measurements within the vehicle energy storage system.

King discloses sampled measures of battery voltage and battery temperature (col 1 ln 35-38 and 30 in Fig. 5), so that the system can compensate for the battery's altered capacity (col 1 ln 42-44) which in turn would prevent reduction of battery life, additional watering maintenance, and wasting energy due to overcharging (col 1 ln 20-23).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method for generating an energy storage control parameter for a vehicle

energy storage system to include receiving one or more actual temperature measurements within the vehicle energy storage system, as was the method of King, so that compensation could be made for the battery's altered capacity in order to prevent reduction of battery life, additional watering maintenance, and wasting energy due to overcharging.

With respect to claim 21, Hoffman, Jr. discloses the method of claim 18 as noted above in the rejection under 35 U.S.C. 102(b), however, does not expressly disclose wherein said estimating a storage bank temperature further comprises utilizing at least one of: a battery cell thermal resistance value, a battery cell heat capacity value, a battery module thermal resistance value, a battery module heat capacity value, a battery assembly thermal resistance value, and a battery assembly heat capacity value.

King discloses a battery pack including a plurality of temperature sensors, each coupled to a respective cell, or module (col 2 ln 45-49 and 30 in Fig. 5), so that the temperature or heat capacity of the battery can be measured and the system can compensate for the battery's altered capacity (col 1 ln 42-44) which in turn would prevent reduction of battery life, additional watering maintenance, and wasting energy due to overcharging (col 1 ln 20-23).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method for generating an energy storage control parameter for a vehicle energy storage system to include the utilization of a battery cell thermal resistance value, a battery cell heat capacity value, a battery module thermal resistance value, a battery module heat capacity value, a battery assembly thermal resistance value, and a battery assembly heat capacity value, as was the method of King, so that compensation could be made for the battery's altered

capacity in order to prevent reduction of battery life, additional watering maintenance, and wasting energy due to overcharging.

17. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hoffman, Jr. (US 5,869,950) in view of King (US 5,659,240) in view of Dunn (US 6,239,579).

With respect to claim 23, Hoffman, Jr. discloses the method of claim 18 and King discloses the method of claim 21, however, they do not expressly disclose the method further comprising:

obtaining a charging/discharging signal from each said energy storage bank; and

filtering each said charging/discharging signal to produce a filtered charging/discharging rate signal;

wherein said filtered charging/discharging signal is used to produce said modified capacity.

Dunn discloses a programmable logic controller or computer which records which module is being discharged/charged and how long it takes to discharge/charge it to a pre-programmed cut-off voltage (col 4 ln 18-20), and that information is used to calculate how much energy the module was able to deliver and what the measure of its useful capacity would be (col 4 ln 20-23 and col 7 ln 37-43), so that the useful capacity of the module can be enhanced and/or the rate of capacity loss of the module can be reduced (col 3 ln 55-57), which in turn increases the time between module replacements. It is implied through Dunn that the PLC must receive a signal in order to record which module is being discharged/charged, and furthermore, the rate would be determined through the use of the time that it takes to discharge/charge to a different voltage.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the method of Hoffman, Jr. and King to include obtaining and filtering a charging/discharging signal from the energy storage banks in order to produce a modified capacity, so that the useful capacity of the module can be enhanced and/or the rate of capacity loss of the module can be reduced, which in turn increases the time between module replacements.

18. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Clegg (US 5,394,089) in view of Ukita (US 5,905,360).

With respect to claim 32, Clegg discloses the method of claim 31 as noted above under 35 U.S.C. 102(b), and furthermore discloses wherein said series of initial battery characterization tests further comprises: a first test, said first test comprising an initial commissioning charge and capacity test (col 1 ln 22-23). However, Clegg does not expressly disclose:

a second test, said second test comprising a full recharge and partial discharge test; and

a third test, said third test comprising a partial charge and partial discharge test.

Ukita discloses a procedure comprising a full recharge and a partial discharge as can be seen in Fig. 5 (col 9 ln 13-20), and a procedure comprising a partial charge and a partial discharge as can be seen in Fig. 5 and Fig. 8 (col 9 ln 46-54), so that an unequal electrode status or unequal electromotive force and excessive charge or discharge, all of which shorten battery life, can be prevented (col 1 ln 30-32 and col 3 ln 49-53).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the characterization tests of Clegg to include a second test comprising a full recharge and partial discharge test and a third test comprising a partial charge and partial

discharge test, so that an unequal electrode status or unequal electromotive force and excessive charge or discharge, all of which shorten battery life, can be prevented.

Allowable Subject Matter

19. Claims 7, 9, 28-30, and 33-39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 7 recites, inter alia, the method of claim 6, wherein: said one or more available energy storage banks are a preferred discharging sink for the designated energy storage bank over said vehicle motoring operation and said resistive grid; and said vehicle motoring operation is a preferred discharging sink for the designated energy storage bank over said resistive grid.

Claim 9 recites, inter alia, the method of claim 8, wherein: said one or more available energy storage banks are a preferred charging source for the designated energy storage bank over said vehicle dynamic braking operation and said combustion engine.

Claim 28 recites, inter alia, the method of claim 27, wherein power flow is prioritized in accordance with the one or more energy storage banks having the highest remaining life cycle.

Claim 29 recites, inter alia, the method of claim 27, further comprising: determining an initial participation factor for each of the energy storage banks, said initial participation factor representing the relative contribution of a given storage bank with respect to the remaining storage banks.

Claim 30 recites, inter alia, the method of claim 29, further comprising: based on said determined remaining life cycle for each of the energy storage banks, generating an adjusted participation factor for one or more of the energy storage banks; wherein an initial participation

factor for a first storage bank having a greater remaining life cycle is increased with respect to an initial participation factor for a second storage bank having a lesser remaining life cycle.

Claim 33 recites, inter alia, the method of claim 32, further comprising adding water to the vehicle storage batter following completion of said first test, if the water level thereof is below a minimum defined level.

Claim 34 recites, inter alia, the method of claim 32, wherein during the performance of said third test, if an output voltage of the storage battery drop s to a first cut-off value, then said third test is aborted and said first test is repeated.

Claim 35 recites, inter alia, the method of claim 34, wherein during the performance of said third test, if an output voltage of the storage battery drops to a second cut-off value, then said third test is aborted and said first test is repeated.

Claim 36 recites, inter alia, the method of claim 35, wherein said first cut-off value is related to a determined level of discharge current spiking associated with said third test, and said second cut-off value is related to a final C rate discharge portion associated with said third test.

Claim 37 recites, inter alia, the method of claim 36, further comprising: repeating said third test for at least a first number, N1 of iterations, wherein N1 represents a specified number of cycles between an initial commissioning charge and a scheduled maintenance of the storage battery; and following at least N1 iterations of said third test, continuing subsequent iterations of said third test until a battery output quantity falls below a corresponding rated quantity of the storage battery, at which time a second number, N2 of total iterations is recorded.

Claim 38 recites, inter alia, the method of claim 37.

Claim 39 recites, inter alia, the method of claim 38.

The art of record does not disclose the above limitations, nor would it be obvious to modify it in such a manner.

Conclusion

20. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yamada (US 5,998,960) discloses a power supply system for an electric vehicle with regenerative breaking. Williams (US 4,958,127) discloses a method an apparatus for determining the state of charge of a battery, including stabilization of the charge distribution. Kozlowski (US 2003/0184307) discloses a diagnostic tool for batteries, including temperature and heat capacity calculations. Tabata (US 6,158,541) discloses an electric energy storage device for an electric vehicle, including charging/discharging of storage portions and checking for service life.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aaron Piggush whose telephone number is 571-272-5978. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Sherry can be reached on 571-272-2084. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

6/13/05

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